THE SUSTAINABLE DEVELOPMENT OF THE HILL AND MOUNTAIN AREA BY VALORISATION OF THE AGROECOLOGICAL RESOURCES IN THE MANAGEMENT OF SEED POTATOES PRODUCTION AND MULTIPLICATION, IN ACCORDANCE WITH THE EUROPEAN UNION STANDARDS

DEZVOLTAREA DURABILĂ A ZONEI COLINAR MONTANE PRIN VALORIFICAREA RESURSELOR AGROECOLOGICE ÎN ORGANIZAREA PRODUCERII ŞI ÎNMULŢIRII CARTOFULUI DE SĂMÂNŢĂ ÎN CONFORMITATE CU STANDARDELE UNIUNII EUROPENE

POMPILICA IAGĂRU[*], GLIGOR CIORTEA[*], ROMULUS IAGĂRU[**]

** Universitatea Lucian Blaga din Sibiu, ** Universitatea Alma Mater din Sibiu*

Abstract: *The cultivation of potatoes all over the world has proved that with all the varieties by growing them year for year a depreciation of the vegetative system of the plant takes place. Implicitly, continuously and progressively the initial production potential degenerates. VELICAN (1959) in his attempt to elucidate the causes and prevention methods for the potato degeneration establishes three basic theories: ecological, physiological aging and virotical. To diminish the percentage of virus-infected plants, a better management of phytosanitary methods in producing seed potatoes is of necessity. Besides this, also a higher proportion of resistant varieties within the admitted assortment is of importance (IAGĂRU, 2005).*

The potato represents for Romania a staple food for the population. High altitudes, the existence of natural barriers create natural conditions for isolating crops and therefore reduce virotic disease propagation (BOZEŞAN, 2003).

Rezumat: *Cultivarea cartofului în întreaga lume a dovedit că la toate soiurile de cartof, prin luarea în cultură an de an, se produce o depreciere a întregului aparat vegetativ al plantei şi implicit o diminuare continuă şi progresivă a potenţialul iniţial de producţie degenerează. Căutând să elucideze cauzele şi mijloacele de prevenire a degenerării cartofului VELICAN (1959), grupează toate aceste păreri şi ipoteze a degenerării cartofului în trei teorii fundamentale: ecologică, prin îmbătrânire fiziologică şi virotică. Pentru scăderea procentului de plante infectate cu virusuri, este necesară stăpânirea mai bună a măsurilor fitosanitare în producerea cartofului de sământă, precum şi creşterea proporţiei de participare a soiurilor rezistente în sortimentul soiurilor admise în cultură. În acest sens se evidenţiază rolul soiului rezistent la viroze şi importanţa ameliorării pentru rezistenţă* (IAGĂRU, 2005).

*Cartoful reprezintă pentru România un aliment de bază a populaţiei. Altitudinile mai ridicate, precum şi existenţa unor bariere naturale creează condiţii naturale de izolare a culturilor şi reduc în felul acesta răspândirea bolilor virotice (*BOZEŞAN, *2003).*

Key words: *potato, the initial production potential degenerates, resistant varieties, altitudes, natural barriers*

Cuvinte cheie:*cartof, potenţialul iniţial de producţie degenerează, soi rezistent, altitudine, bariere naturale*

INTRODUCTION

In order to analyse the possibility of obtaining planting material with correct phytosanitary and biological value outside the closed areas of potato, we organized an experiment in three locations as follows: the base biological category material produced at

Braşov is propagated in the agricultural area of Avrig and Sibiu for a period of time of two years in order to obtain the biological categories class A and class B that will constitute the planting material for the farmers. During the experiment, we also observed:

The evolution of aphids in seed potato crops in the fields: Păltiniş, Avrig, Sibiu;

The possibilities of seed potato propagation outside the closed areas.

MATERIALS AND METHOD

1. The experiments concerning the evolution of aphid populations in seed potato crops in the fields had as aim to establish the favourability rate of the area for propagating the potato planting material. At the same time to establish the best moment to break off vegetation of the aphid affected potato in order to limit the attack of viruses from stalk and leaves to the tuber;

2. The experiments concerning the research of possibilities to propagate the seed potato outside the closed areas had as aim obtaining the biological category Class B in areas or specialized farms from the biological material produced at Braşov and propagated one year at Păltiniş.

RESULTS AND DISCUSSION

Evolution of the Aphid Populations in the Seed Potato Crops of the Experiment Fields, Păltiniş, Sibiu and Avrig

The research conducted in the period 1999-2003, in the specific conditions of Sibiu County, in the potato crops had the following interests:

1. Monitoring aphid flights from seed potato crops in order to determine the aphid fauna specific for the areas of the experiments;

2. The dynamics of the aphid populations with major interest on the main potato virus vector species;

3. Analyses of the relationship between the dynamics and the size of the aphid populations, specific for each year of the experiment cycle, on the one hand, and the seed potato virotic disease frequency, on the other;

4. The study of ecological conditions influences and determining the biological cycle of the main aphid species as potato virus vectors: *Myzus persicae* Sulzer, *Aphis frangulae* Kalt, *Aphis fabae* Scopoli, *Brevycorine brassicae* L., *Phorodon humuli* Schrank and *Schizaphis graminum* Rondani.

The growth of Seed Potato Virus Vector Aphids within the Agroecosystem

There is a close correlation between the speed of biochemical processes characteristic of each species and the temperature and this has permitted the formulation of mathematical equations very different from one species to another. The equation of the **temperature constant** may successfully contribute to the *explication of the growing, developing, propagating processes and the biological spreading of the species.*

BLUNCK (1914, 1923) has elaborated the equation of the **temperature constant** (K), which he defines as the product between development time (x_n) and the actual temperature (t_n-t_o) this being the same no matter the place of the experiment:

$$K = X_n(t_n-t_o) \qquad (A)$$

Starting from experiment accurate determinations, with the help of equation (A) we can mathematically express the **inferior biological threshold** (t_o) specific for the species as well as the temperature constant (K).

Based on the temperature constant for each aphid species we have determined:

- the prolificacy threshold (O);
- the best temperature threshold (O_1);
- the superior temperature threshold (T)
- the regression line constant (C);
- the tropic constant (X);
- the propagating equation (γ)

The species biological constant

The paper brings a detailed study and determination of the growth, and propagation constant, the dynamics of species for the following potato planting material viruses vector aphids in the County of Sibiu:

- Myzus persicae Sulzer;
- The species complex Aphis frangulae Kalt and A. nasturtii Kalt; Aphis fabae Scopoli ; Brevicoryne brassicae;
- Macrosiphum euphorbiae Hott et Fris.

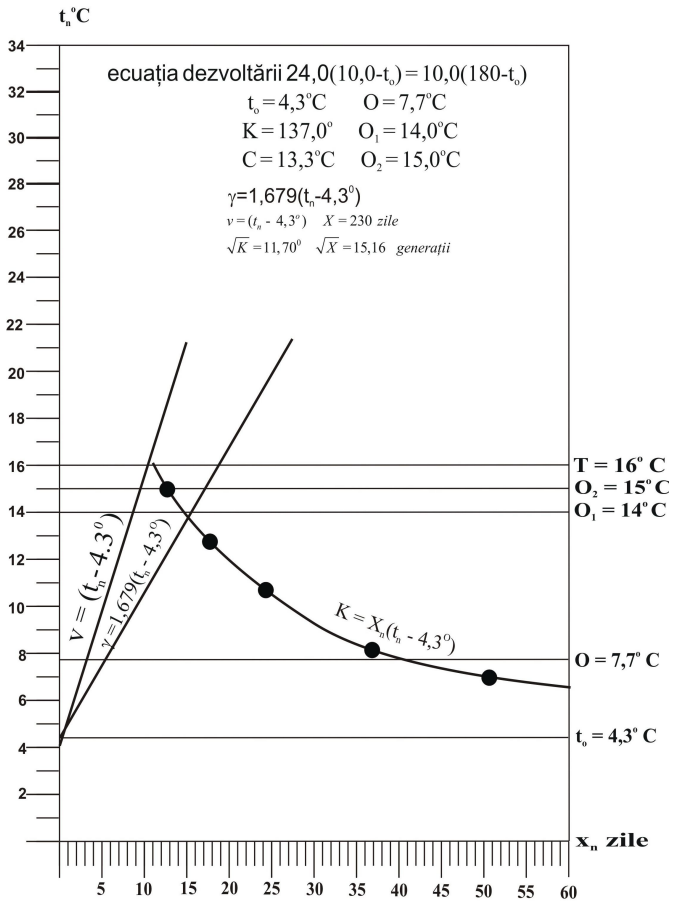

Fig. 1. The graphic of growth, development and Propagation of the peach-tree green louse Myzus persicae S.

Because of the big amount of personal research that is difficult to be resumed in an abstract we give a overview of the material for the *Myzus persicae* Sulzer species, the strongest potato virus vector.

The Constant of the peach tree green louse (Myzus persicae Sulzer) during the experiment period (1999-2003) in Sibiu

The main constants of the Myzus persicae Sulzer are presented in fig. 1.

Table 1 presents the evolution of the peach tree green louse in the period 1999-2003 and as multi-annual average values.

Table 1

Annual Dynamics for the Peach Tree Green Louse (*Myzus persicae* Sulzer), at Sibiu 1999-2003 and multi-annual values

Last spring frost t_{min}< -2°C		Year (period)	Primary Host					Secundary Host										Primary Host		Duration of first frost t_{min}<-2°C	
			F	Fg I	Fg II	Fg III	Fg IV	V I	V II	V III	V IV	V V	V VI	V VII	V VIII	V IX	VS X	S	Dep. ou iarnă		
-2,1	24,03	1999	17.04	10.05	25.05	4.06	13.06	23.06	3.07	11.07	21.07	30.07	9.08	18.08	29.08	11.09	23.09	5.10	15.10	-4.9°C	17.10
-4,5	3,04	2000	16.04	29.04	12.05	25.05	5.06	13.06	23.06	3.07	11.07	23.07	1.08	10.08	19.08	28.08	11.09	24.09	4.10	-4.7°C	20.10
-2,2	4,04	2001	7.04	30.04	14.05	26.05	8.06	18.06	30.06	10.07	18.07	28.07	5.08	14.08	23.08	4.09	20.09	4.10	14.10	-2.0°C	25.10
-3,4	8,04	2002	20.04	6.05	18.05	28.05	10.06	19.06	27.06	6.07	14.07	23.07	2.08	11.08	22.08	2.09	17.09	4.10	14.10	-3.0°C	20.10
-3,7	8,04	2003	29.04	9.05	19.05	30.05	8.06	16.06	26.06	4.07	16.07	24.07	2.08	11.08	19.08	28.08	8.09	6.10	16.10	-5.8°C	19.10
-3,2	4,04	Average 1999-2003	18.04	5.05	18.05	29.05	9.06	18.06	28.06	7.07	16.07	26.07	4.08	13.08	22.08	2.09	16.09	3.10	13.10	-4.0°C	20.10
-2,4	14,03	Plurianual average	24.04	10.05	23.05	3.06	14.06	25.06	5.07	14.07	23.07	1.08	10.08	20.08	30.08	10.09	24.09	11.10	21.10	-2.2°C	15.10

Date of emmigration flight

Date of back-migration flight
Year 2003 virginogenes of IXth generation 22.09

NOTE:
F = Fundatrix
Fg = Fundatrigene
V = Virginogene aptere
Vs = Virginogene sexupare
S = Sexuate ? aripați
? aptere

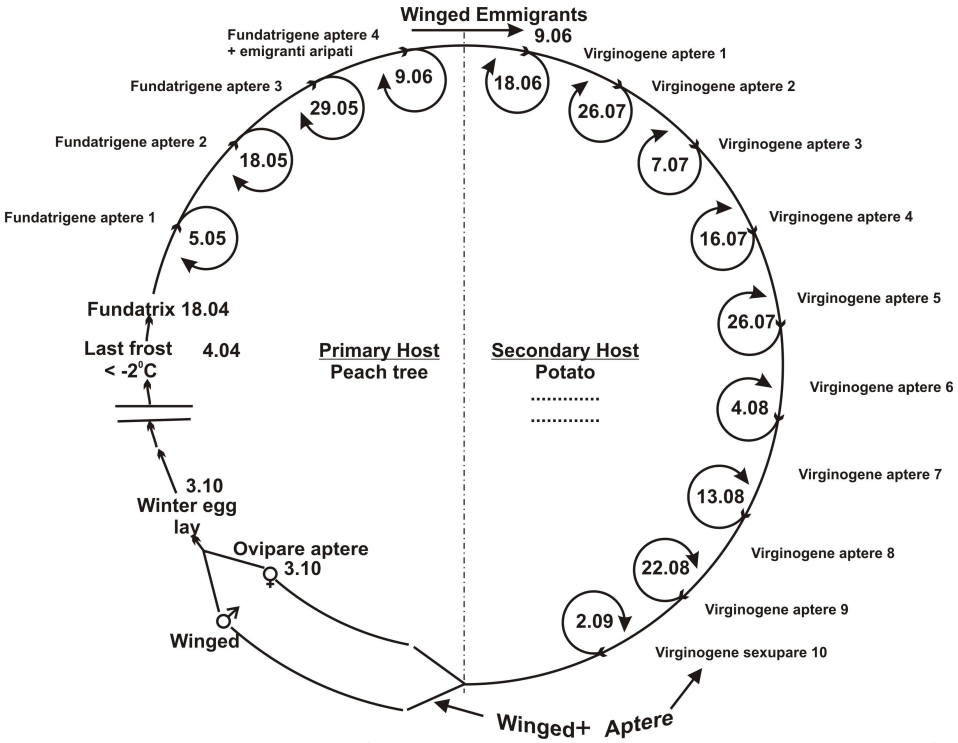

Fig. 2 presents the dioecic holocycle of the peach tree green louse in the ecoclimatic conditions specific of the average values of the period of experiments 1999-2003.

From the study of MEIER in Switzerland it results that the higher the altitude the appearance of the Myzus persicae Sulzer species on secondary hosts thus on the potato is delayed with 30 days at altitudes of 850-1000 m. That means that the summer flight delays up to the 14-15th of July. At altitudes between 1000-1500 m, the aphids' summer flight begins only on the 15th of August, and at altitudes of 1850 m, it delays up to the beginning of September.

Aphid Development in the Păltiniş Area

In mountain conditions, aphid development depends on temperature and the existence of primary hosts on which the first part of these aphids holocycle takes place.

According to the research of DRĂGULESCU (2003) in the area of Păltiniş there are no primary hosts to be found for the major part of aphid species.

Our research fully confirm the data presented by MEIER (1958) for Switzerland who showed that the appearance of the Myzus persicae Sulzer species on the secondary hosts and thus on the potato is delayed the higher the altitude.

In the ecoclimatic specific conditions at the altitude of 1420 m in Păltiniş, although there are primary hosts for the *Macrosiphum euphorbiae* Hott et Fris species, the local development is practically impossible.

In this context, from the study of the bioclimatic diagram the propagation of the species Macrosiphum euphorbiae Hott et Fris in the conditions of precipitations and temperature specific for Păltiniş in the year 2003 it results that for this area this species has no proper conditions for growth and development.

Maintaining the phytosanitary standard for the potato planting material propagated at Păltiniş

The phytosanitary quality of the potato planting material is determined by the degree of virotic infection. Therefore, a very important aspect in obtaining best planting material is keeping the degree of virotic infections at low level.

Maintaining the phytosanitary standard for the potato planting material propagated at Sibiu and Avrig

The measures for keeping virotic infections at low level differ according to the manner of virus transmission. According to the determination of the degree of infection with viruses in the potato planting material propagating lots at Sibiu the certified biological category (class A) confirms to the standard limits concerning the overall percentage of heavy viruses and the percentage of viruses considered high.

CONCLUSIONS

1. In the Sibiu area, the seed potato viruses vector aphids appear from the first days of potato springing keeping at high rate along June and July decreasing in August;

2. In the Făgăraş region, where Avrig is situated, the abundance of viruses vector aphids is half compared to Sibiu region because of the colder climate due to cold air from the Făgăraş Mountains slopes;

3. In the area of potato fields in Păltiniş, aphids appear carried at long distances by passive flight (wind transported) with a 40-45 days delay compared to Sibiu;

4. The first and second decade of August is the time of viruses vector aphids in Păltiniş. This means 10-20 days before potato stalk destruction thus the migration of viruses to the tubers is stopped;

5. In these conditions producing potato seed in the high regions of Păltiniş ensures virus free seeding material that is propagated in the cold submountain region thus ensuring the needed seed for Sibiu county avoiding long and expensive transportation from the closed areas of seed potato production;

6. Important is also the variety cultivated due to sensitivity to viruses or due to anatomic characteristics that may favour or stop persistent virus inoculation;

7. Through coordinates of growth, development and propagation a prognoses of the holocycles of different species is possible, the aphides being insects most suitable to mathematical modelling;

8. The virus infection percentage after the first and second propagation year for the potato planting material from Păltiniş is considerably determined by the evolution of the aphid population (the main potato viruses vector – Myzus persicae), by the dimension of the infection source from outside the crop and is less determined by the initial infection of the material;

9. At present, the seed potato production of the certified biological category is organized only in counties with closed areas. It is absolutely necessary that the other counties too direct their research towards organizing specialized areas (closed microareas) in order to obtain seed potato of certified biological category Classes A and B in the mountain and highland region;

10. Obtaining biological category Class B outside the closed areas in Sibiu County is a solution to provide the need for seed potato for the whole area and provides also the premises to increase production by generalizing the use of biological category Class B for planting food potato crops;

LITERATURE

1. BÎLTEANU GH., " Fitotehnie, vol. II "., Editura Cores, Bucureşti, 1993.
2. BLACKMAN R. L., EASTOP W. F., "Aphid in the World's Crops. An Identification Guide John Wiley and Son Chichester", London, 1985
3. BOZEŞAN I., "Soiul – factor important în realizarea unor producţii mari în condiţii de irigare", 2000, Rev."Cartoful în România",nr.3,vol. 10;
4. BOZEŞAN I., "Cultura cartofului în zonele de munte", 2003, Revista "Cartoful în România", nr.3, vol. 13, 13-16
5. BUIUC M., "Estimarea radiaţiei solare pe teritoriul României în Studii şi Cercetări – Fundamentarea meteorologică şi hidrologică a resurselor energetice neconvenţionale", Institutul de Meteorologie şi Hidrologie, Bucureşti, 1984.
6. DRĂGULESCU, C., - Cormoflora judeţului Sibiu, Editura Peleanus, Braşov, 2003
7. GOREA T., CATELLY T., MAN S., GROZA H., DRAICA C., Contribuţia soiului şi a materialului de plantat la creşterea producţiei de cartof, 1982, Buletin Informative A.S.A.S., vol. 15.
8. IAGĂRU, P., PSENICICA S., IAGĂRU, R., - Sistemul producerii şi reînnoirii cartofului pentru sămânţă în judeţul Sibiu", Lucrările Conferinţei "Ştiinţe, procese şi tehnologii agro-alimentare", Ed. Univ. Lucian Blaga, Sibiu, 2002.
9. IAGĂRU POMPILICA, IAGĂRU ROMULUS „*The management of implementing quality devices in producing potato seed material in montain and submontaine regions of Romania"* Conferinţă internaţională Eficienţă, Legalitate, Etică în Economiile Postaderare Lucrările celei de a XVI-a sesiune de comunicări Alma Mater Sibiu ISBN 973-632-312-9, 978-973-632-312-6, 2006.
10. IAGĂRU POMPILICA, „Cercetări privind producerea de material de sămânţă la cartof în condiţii de zone libere de viroze" Teză doctorat Universitatea din Craiova, 2005.